



THE REPRESENTED WORLD

Communication: Packaging



STEM Road Map Module Title

Communication: Packaging

STEM Road Map Theme

The Represented World

Grade Level

Sixth Grade

Authors

Adrienne Redmond-Sanogo, Sue Christian Parsons, Janet B. Walton, Carla C. Johnson, & Erin E. Peters-Burton

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Johnson, C. C., Moore, T. J., Utley, J., Breiner, J., Burton, S. R., Peter-Burton, E. E., Walton, J., & Parton, C. L. (2015). The STEM road map for grades 6-8. In C. C. Johnson, E. E. Peters-Burton, & T. J. Moore (Eds.), *STEM road map: A framework for integrated STEM education* (pp. 96-123). New York, NY: Routledge.

See <https://www.routledge.com/products/9781138804234> for more information about *STEM Road Map: A Framework for Integrated STEM Education*.

STEM Road Map Curriculum Module

STEM Road Map Module Theme and Grade Level: Represented World – Sixth Grade

STEM Road Map Module Topic: Communication - Packaging

Lead Disciplines: Mathematics and English/Language Arts

Module Summary

In this module students will explore packaging as a means to not only ensure a product's safety as it is delivered to consumers, but also as a marketing tool. Students will consider the geometrical properties of packaging and will be challenged to redesign a product's packaging in a way that protects the product during shipping while appealing to consumers. Students will also design a product logo and an advertisement for their product as elements of a marketing campaign (adapted from Johnson et al., 2015; see <https://www.routledge.com/products/9781138804234>).

Established Goals/Objectives

Students will be able to:

- Understand that companies create, design, and market products purposefully, targeting specific audiences to maximize profits.
- Understand the sustainability issues associated with packaging and manufacturing of products.
- Understand how surface area and volume are used in packaging and manufacturing.
- Calculate surface area and volume of three-dimensional figures and develop a general formula.
- Understand that marketing is a complex process that requires feedback from a target audience and revisions as needed.
- Understand that all media messages are constructed and, when engaging with a media message, consider who created it and for what purpose.
- Understand that media messages are constructed using a creative language with its own rules and, when engaging with a media message, consider what techniques are being employed to attract buyer attention.
- Understand that different people experience the same media message differently, and consider their own stances and how others might view it differently.
- Understand that most media messages are organized to gain profit or power, considering why a message was sent and how to construct an effective marketing message.
- Select and use multiple forms of media (visual and textual) to convey information about a product and persuade an audience to buy it.

Challenge and/or Problem for Students to Solve

PRODUCT PROS COMPETITION GUIDE

Welcome to the Product Pros competition! You have been chosen because of your outstanding job performance and demonstrated potential for excellence in design and marketing. At stake are a salary bonus and the opportunity to work on an exciting new product design campaign. Your challenge is as follows:

Working with a team of your peers, you will redesign a familiar product and create packaging and a marketing campaign, resulting in a hot new product for sale by our company.

YOUR CHALLENGE!

PRODUCT: Choose a familiar product with potential to be redesigned for marketing to a new user, thus expanding the market base and, thus, company revenue. Product parameters:

1. Useful and/or highly appealing to a particular consumer group
2. Fragile enough to need protection during shipping

PACKAGING: Design packaging for both shipping and display. Packaging parameters:

1. Match consumer expectations for the project, yet differentiate itself from similar products
2. Use materials already produced by our company (and, thus, is cost effective)
3. Have a design that is unique and bold in order to attract buyers in the target range
4. Be sustainable
5. Be strong enough to ship and display safely on store shelves

MARKETING: Design a design a highly effective product logo and multimodal marketing campaign. Campaign parameters:

1. Logo is highly appealing, unique, bold, and memorable in order to attract and retain buyers.
2. The campaign tells a story, has a focus, and creates a journey that leads the consumer where you want him or her to go.
3. The story of your product is told effectively across a variety of market mediums—"brick and mortar" (an actual store such as one that you would visit in your community), online, print/visual media, etc.

PRODUCT TESTING: Test your product for reliability and appeal, and redesign as needed.

Quality parameters:

1. Packaging passes a "crush test" designed to demonstrate protection of the product
2. Focus group results demonstrates appeal to potential clients

COMPETITION: Present your product, packaging design, and marketing campaign to a panel of company executives. The presentations will be judged on the following criteria:

- Product selected clearly meets the criteria, and the evidence is clearly articulated in the presentation
- Packaging design clearly meets the criteria, and the evidence is clearly articulated in the presentation
- Marketing campaign clearly meets the criteria, and the evidence is clearly articulated in the presentation
- Product testing clearly matches the criteria, and the evidence is clearly articulated in the presentation
- Presenters appear to be well- prepared, speaking clearly and coherently and making eye contact
- Presentation is energetic, creative, and engaging.

Content Standards Addressed in STEM Road Map Module

Next Generation Science Standards	Common Core Mathematics	Common Core English/Language Arts (ELA)
<p>MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.</p> <p>MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.</p> <p>MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.</p> <p>MS-PS1-3 Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.</p> <p>MS-ESS3-3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.</p> <p>MS-LS1-1 Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.</p> <p>MS-LS1-3 Use argument supported by evidence for how the body is a system of</p>	<p>Math Practices MP1 Make sense of problems and persevere in solving them. MP3 Construct viable arguments and critique the reasoning of others. MP4 Model with Mathematics MP5. Use appropriate tools strategically. MP6. Attend to Precision</p> <p>Content Standards 6.RP.A.3.C Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.</p> <p>6.RP.A.2 Understand the concept of a unit rate a/b associated with a ratio $a:b$ with $b \neq 0$, and use rate language in the context of a ratio relationship.</p> <p>6.SP.A.1 Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers.</p> <p>6.SP.A.3 Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.</p> <p>6.SP.B.5.B: Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.</p> <p>6.SP.B.5.C: Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking</p>	<p>LITERACY.RH.6-8.4 Determine the meaning of words and phrases as they are used in a text, including vocabulary specific to domains related to history/social studies.</p> <p>CCSS.ELA-LITERACY.RI.6.2 Determine a central idea of a text and how it is conveyed through particular details; provide a summary of the text distinct from personal opinions or judgments.</p> <p>CCSS.ELA-LITERACY.RI.6.6 Determine an author's point of view or purpose in a text and explain how it is conveyed in the text.</p> <p>CCSS.ELA-LITERACY.W.6.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.</p> <p>CCSS.ELA-LITERACY.W.6.6 Use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others; demonstrate sufficient command of keyboarding skills to type a minimum of three pages in a single sitting.</p> <p>CCSS.ELA-LITERACY.WHST.6-8.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.</p> <p>CCSS.ELA.LITERACY.WHST.6-8.6 Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.</p> <p>CCSS.ELA-LITERACY.WHST.6-8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.</p>

Next Generation Science Standards	Common Core Mathematics	Common Core English/Language Arts (ELA)
interacting subsystems composed of groups of cells.	<p>deviations from the overall pattern with reference to the context in which the data were gathered.</p> <p>6. EEA.2: Write, read, and evaluate expressions in which letters stand for numbers.</p> <p>6.EEB.6: Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set</p>	CCSS.ELA-LITERACY.WHST.6.10 Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

21st Century Skills Addressed in STEM Road Map Module

21 st Century Skills	Learning Skills & Technology Tools (from P21 framework)	Teaching Strategies	Evidence of Success
21st century interdisciplinary themes	<ul style="list-style-type: none"> Global Awareness Financial, Economic, Business, and entrepreneurial literacy Civic Literacy Environmental Literacy Health Literacy (Understanding Viruses and how we can prevent them from spreading) 	<ul style="list-style-type: none"> Understand other cultures and nations Know how to make appropriate personal economic choices Understand the role of the economy in society Understand the global implications of civic decisions Understand the environment and circumstances and conditions affecting it Understand environmental issues and make accurate conclusions about effective solutions Understand 	<ul style="list-style-type: none"> Students will explore how our purchasing decisions impact their fellow human beings in other nations by exploring cocoa production, fair trade, and social justice projects. Students will explore targeted marketing strategies and deceptive marketing practices. They will explore how they have been a target of the market and the power of their purchasing decisions. Students will explore how their purchasing decisions at home have an impact on others. Students will explore the importance of purchasing sustainable packages and recycling

21 st Century Skills	Learning Skills & Technology Tools (from P21 framework)	Teaching Strategies	Evidence of Success
		preventative physical health measures.	<ul style="list-style-type: none"> Students will explore the structure of viruses, how they replicate, and how viruses can and can't spread.
Learning and innovation skills	<ul style="list-style-type: none"> Creativity and Innovation Critical Thinking and Problem Solving Communication and Collaboration 	<ul style="list-style-type: none"> Use a wide range of idea creation techniques Create new and worthwhile ideas Elaborate, refine, and analyze their own ideas in order to improve and maximize creative efforts. Use critical thinking to solve real world problems Collaborate with others to solve problems Communicate skills in a variety of forms and contexts Listen effectively to decipher meaning. 	<ul style="list-style-type: none"> Students will participate in both divergent and convergent ideation sessions to develop innovative solutions, product packaging, project logos, and marketing strategies. Students will evaluate marketing messages and decipher their meaning. Students will create a social justice project and sustainability project in which they will use critical thinking and problem solving. Students will communicate their ideas and thoughts in a variety of ways (e.g. social media campaign. PowerPoint presentation, letter to a company, professional e-mail.) Students will present their marketing project to a panel of experts.
Information, media and technology skills	<ul style="list-style-type: none"> Information Literacy Media Literacy ICT Literacy 	<ul style="list-style-type: none"> Have students use nonfiction text to research sampling techniques and develop their mathematical model Help students use multi-media tools to present their findings 	<ul style="list-style-type: none"> Students present to peers, teachers and a panel of experts using multimedia tools. Students' reflection on the use of nonfiction text.
Life and career skills	<ul style="list-style-type: none"> Flexibility and Adaptability Initiative and Self-Direction, 	<ul style="list-style-type: none"> provide guidelines for effective peer critique and use how to use this 	<ul style="list-style-type: none"> Project rubrics

21 st Century Skills	Learning Skills & Technology Tools (from P21 framework)	Teaching Strategies	Evidence of Success
	<ul style="list-style-type: none"> • Social and Cross Cultural Skills, • Accountability, Leadership, and Responsibility 	feedback to improve presentation <ul style="list-style-type: none"> • establish collaborative learning expectations • scaffold completion of tasks 	

Launch

Before students enter the room, create a display of products with nested construction and visually engaging packaging, etc.: examples that demonstrate the kinds of product packaging students will seek to create. As much as possible, the items should be showcased for dramatic effect using, for example, labels, lighting, and background music. As students enter the room, hand each a name badge, and welcome them to the Product Pros competition launch. Once students have gathered, invite them to visit the display with the following question in mind: What aspects of the products displayed might make them appealing to a buyer?

Prerequisite Key Knowledge

Prerequisite key knowledge	Application of knowledge	Differentiation for students needing knowledge
Science		
<ul style="list-style-type: none"> • Students need to understand the difference between living and non-living things. • Students have made observations and measurements to identify materials based on their properties in fifth grade. • Students have built models of plant and animal cells and know the difference between bacteria and virus. • Students have had experience exploring the movement of matter among plants, animals, decomposers, and the environment. • Students obtained and combined information about ways individual communities use science ideas to protect the Earth's resources and environment. 	<ul style="list-style-type: none"> • In this module, students will be applying their understanding of living and non-living things in their debate about viruses. • Students will be using their observation and measurement skills throughout the entire module. • In this module, students will be expanding on their knowledge of the differences between bacteria and viruses. • Students will explore sustainability in this module and it will be important for students to have experience with understanding how we can protect the Earth's resources. • Students will expand upon their understanding of representing and graphing data to answer 	<ul style="list-style-type: none"> • If students do not understand the difference between living and non-living things, you can provide students with a lab beforehand that allows them to classify things as living and non-living. You can use animations and videos as well. • Students may need to work with their partner if their measurement skills or observation skills are not defined. The teacher can provide some technology tools (digital thermometers, etc.) to help students who are unable to use instruments to measure. • If students have not had experience building cells, the teacher can provide this experience for them. They can

Prerequisite key knowledge	Application of knowledge	Differentiation for students needing knowledge
<ul style="list-style-type: none"> Students have had experience representing data in graphical displays to reveal patterns in data. Students spent time in their upper elementary classes exploring engineering design and can define simple problems, generate and compare multiple solutions, and plan and carry out fair tests. 	<p>questions in the module.</p> <ul style="list-style-type: none"> Students will expand on their engineering experiences in upper elementary to use the engineering design process to solve complex problems. 	<p>also use animations to examine how cells function.</p> <ul style="list-style-type: none"> Students can use technology resources to produce graphical representations of data. In this lesson, the teacher will be scaffolding instruction to support students who have had little experience with engineering design.
Mathematics		
<ul style="list-style-type: none"> Students had experiences with solving challenging problems in the upper elementary grades. Students explored fractions and decimals in elementary and will build upon that knowledge to explore percent concepts. Students have explored different ways to display data in both whole number and fractional units to solve problems. Students have explored concepts of area of various two dimensional shapes. Students have recognized that volume is an attribute of solid figures and that unit cubes can be used to measure volume. Students have named and explored characteristics of three-dimensional shapes. 	<ul style="list-style-type: none"> Students will expand their ability to solve problems by solving real-world problems. Students will extend their understanding of decimals and fractions to develop an understanding of percent and how they are used in real-world problems. Students will expand on their ability to represent data by designing their own study, collecting data, and using measures of center to describe the data. Students will expand on their understanding of area, perimeter, and volume to find surface area and volume of three dimensional figures. Students will move beyond simple classification of three-dimensional shapes to explore their properties in more depth. 	<ul style="list-style-type: none"> Lessons will be scaffolded to support students problem solving. Students will be working with a partner or small group to support their learning. Students who struggle with fraction concepts can use calculators and physical models to solve problems. Students can use technology to represent data and explore measures of center. Students who have not developed a conceptual understanding of area, perimeter, and volume may need the experiences prior to and during the lesson for support. Sorting activities will be essential to helps students move from level 0 of the van Hiele level of Geometric thought. The lesson is scaffolded so that it provides support to all learners.
ELA		
<ul style="list-style-type: none"> Students need to know the difference between fiction and non-fiction texts. Students need to write for a variety of purposes. 	<ul style="list-style-type: none"> Students will be exploring a variety of non-fiction text structures in this lesson. Students will write blog responses, letter to the company, develop multimedia presentations, and create marketing campaigns in this 	<ul style="list-style-type: none"> Supports are built in to each lesson.

Prerequisite key knowledge	Application of knowledge	Differentiation for students needing knowledge
	module.	
Social Studies		
<ul style="list-style-type: none"> Students need to know about proper nutrition and fresh foods. Students need to have experience with using fact and opinion in an argument. Students have had experiences filming, editing, and developing multimedia presentations. Students need to be able to research using the Internet. 	<ul style="list-style-type: none"> In this module, students will be exploring food deserts and swamps and will need to know the difference between processed foods and fresh foods. Students will develop a fact-based argument in their multimedia presentations in lesson 1. Students will have to use video and presentation software to create a multimedia presentation in lesson 1. In lesson 2, students will be exploring social justice issues and will need to be able to conduct research on the internet. They will need to be able to evaluate the validity of sources. 	<ul style="list-style-type: none"> If students have had limited experiences with fresh produce and meats, it will be important to provide students with examples and experiences that help them understand the difference between fresh and processed. Teachers can provide students with a handout that shows the difference between a fact – based argument and one with just opinion. The teacher may need to enlist the help of the technology expert in the building to help students who are struggling with their multimedia projects. The teacher can also pair students with a knowledgeable peer. Lessons are scaffolded to embed research skills throughout.

Desired Outcomes and Monitoring Success

Desired Outcome	Evidence of Success in Achieving Identified Outcome	
	Performance Tasks	Other Measures
Students will work in a team to develop packaging, create a logo, and develop a marketing strategy that they will present to a panel of experts.	Students will be assessed using project rubrics that focus on content and application of skills related to academic content.	The project rubrics have participation built in so there are no separate measures.

Assessment Plan

Major Group Products	<ul style="list-style-type: none">• Packaging Design Project• Module Project• Save the Chip Design Project
Major Individual Products/Deliverables	<ul style="list-style-type: none">• Participation in group activities• Too Many Broken Chips handout

Resources

School-based Individuals:

- Team of Judges (Teachers and administrators with ELA and Math expertise)
- Someone to help with technical issues and presentations if issues arise
- Librarian

Technology:

- Computer/Tablets/Laptops for student research
- Digital Cameras (optional)
- Projector
- Word Processing Software
- Presentation Software (e.g. PowerPoint)

Community:

- Marketing Specialist
- Local manufacturing plant for field trip

Materials: Materials lists are provided within each lesson.

STEM Road Map Module Timeline

STEM Road Map Module Schedule Week One

Day 1	Day 2	Day 3	Day 4	Day 5
<i>Lesson 1 The Product</i>	<i>Lesson 1 The Product</i>	<i>Lesson 1 The Product</i>	<i>Lesson 1 The Product</i>	<i>Lesson 2 The Packaging</i>
Introduce the module and challenge.	Finish Shipped Chips/Three Act Lesson activity.	Students participate in the Save the Chip Challenge.	Complete Save the Chip Challenge.	Students explore sustainable packaging.
Discuss product photos from grocery store (Where's My Stuff?)	Students complete Doritos Locos activity.		Message in a Bottle activity.	Complete Shape Show activity.
Begin Shipped Chips/Three Act Lesson activity.				
(An optional field trip to a grocery store can be incorporated on any day of Lesson 1).				

STEM Road Map Module Schedule Week Two

Day 6	Day 7	Day 8	Day 9	Day 10
<i>Lesson 2</i> <i>The Packaging</i>	<i>Lesson 3</i> <i>Product Pros</i>	<i>Lesson 3</i> <i>Product Pros</i>	<i>Lesson 3</i> <i>Product Pros</i>	<i>Lesson 3</i> <i>Product Pros</i>
Guest speaker (local manufacturer to discuss packaging and sustainability issues) or field trip to factory floor or local manufacturer.	Students explore marketing and commercial scripts in the Marketing Mania activity. Review Product Pros Challenge requirements. Student teams begin work on challenge.	Students continue work on Product Pros challenge.	Students continue work on Product Pros challenge.	Students complete work on Product Pros challenge. Package testing Student teams present their packaging and marketing materials.

Lesson Plan #1
Represented World - Communication – 6th Grade

Lesson Title: The Product

Lesson Summary

In this lesson, teachers provide an overview of the module and introduce the challenge. Students will explore packaging through an investigation of Doritos chips and will begin to create their own product packaging. A field trip to a local grocery store is an option for this lesson.

Essential Question(s)

- What is the engineering design process and how do engineers use it to solve problems?
- What are some ways that companies create, design, and market products to entice consumer spending?
- How is mathematics used as a tool for solving design, marketing, and shipping issues?

Established Goals/Objectives:

Students will be able to:

- Understand that companies create, design, and market products purposefully, targeting specific audiences to maximize profits.
- Understand that packaging serves multiple functions for companies.
- Understand that the geometric shapes used in packaging affect the function and appearance of a product's packaging.
- Understand that the materials used in packaging affect the function and appearance of a product's packaging.

Time Required

4 days (90 minutes each)

Necessary Materials

- Computer and projector (to watch videos and share ideas)
- Tablets or laptops for student research and presentations
- Copies of Engineering Design Process Poster and all student handouts within lesson
- Doritos Locos Taco or Picture of Dorito Locos Taco
- 5 pound weight
- Cardboard (1 large box per 3 students)
- Duct Tape (1 per 3 students)
- Plastic Storage Bags (1 per 3 students)
- Popsicle Sticks (10 per 3 students)
- Glue (1 per 3 students)
- Rubber bands (10 per 3 students)
- Paper (3 sheets per 3 students)
- Large bag of Doritos (3 per 3 students)
- Snack size bags of Doritos (1 per student)
- Paper towels (1 roll)
- Sticky Notes

Standards Addressed in STEM Road Map Module Lesson
Next Generation Science Standards <ul style="list-style-type: none">• MS-ETS1-1• MS-ETS1-2• MS-ETS1-3
Common Core Mathematics <p>Math Practices</p> <ul style="list-style-type: none">• MP1. Make sense of problems and persevere in solving them.• MP3. Construct viable arguments and critique the reasoning of others.• MP4. Model with Mathematics• MP5. Use appropriate tools strategically.• MP6. Attend to Precision <p>Content Standards:</p> <ul style="list-style-type: none">• Content.6.RP.A.3.C.• Content.6.SP.A.1• Content.6.SP.A.3• Content.6.SP.B.5.B• Content.6.SP.B.5.C
Common Core ELA <ul style="list-style-type: none">• CCSS.ELA-LITERACY.RH.6-8.4• CCSS.ELA-LITERACY.RI.6.2• CCSS.ELA-LITERACY.RI.6.6

- CCSS.ELA-LITERACY.W.6.4
- CCSS.ELA-LITERACY.W.6.6
- CCSS.ELA-LITERACY.WHST.6-8.4
- CCSS.ELA-LITERACY.WHST.6-8.6
- CCSS.ELA-LITERACY.WHST.6-8.8
- CCSS.ELA-LITERACY.WHST.6.10

21st Century Skills

Information, Media and Technology Skills:

- Information Literacy
- Media Literacy
- ICT Literacy

Life and Career Skills:

- Initiative and Self-Direction,
- Social and Cross Cultural Skills,

Key Vocabulary	Definition
Icon	A widely recognized person or symbol
Symbolism	Using an object or other concrete concept to allude to an abstract concept or idea
Marketing	The total of activities involved in the transfer of goods from the producer or seller to the consumer or buyer, including advertising, shipping, storing, and selling.
Logo	A graphic representation or symbol of a company name, trademark, abbreviation, etc., often uniquely designed for ready recognition.
Manufacturer	A person, group, or company that owns or runs a manufacturing plant.
Consumer	A person or organization that uses a commodity or service.
Media Literacy	Media literacy is the ability to critically comprehend, analyze, and thus engage productively with and respond to media messages from an empowered stance.
Visual Imagery	The use of vivid or figurative language to represent objects, actions, or ideas.
Ideation Session	Gathering a group of individuals to create and discuss new ideas. Divergent ideation occurs when teams or individuals think about a solution to a problem alone. Convergent ideation occurs when teams all come together to share solutions and choose a strategy that works best.
Prototype	An original, full-scale, and usually working model of a new product or new version of an existing product.
Lateral Thinking	Solving problems through an indirect and creative approach, using reasoning that is not immediately obvious and involving ideas that may not be obtainable by using only traditional step-by-step logic. Edward de Bono coined the term in 1967.

Key Vocabulary	Definition
Innovations	Introducing something new
Shipping	Freight transport is the physical process of transporting commodities and merchandise goods and cargo.
Safety parameters	Limits or boundaries provided on the activity to provide a safe environment for all involved.
Mean (arithmetic mean or average)	The mean obtained by adding several quantities together and dividing the sum by the number of quantities:
Median	The middle number in a given sequence of numbers, taken as the average of the two middle numbers when the sequence has an even number of numbers:
Mode	The number that occurs most often in a set of data.
Researchable	A question that is able to be answered using a systematic inquiry or investigation.
Refute	Prove (a statement or theory) to be wrong or false; disprove

Teacher Background Information

This lesson provides students with the opportunity to learn about the engineering design process, engineer solutions to real problems, and use that knowledge to think about social issues. The following background information will help teachers to engage their students in this lesson.

The engineering design process (EDP) is a series of steps that engineers go through to solve problems. A graphic representation of the steps of the EDP is attached at the end of this lesson. You may wish to provide this to students or post it in the classroom for student reference. When using the EDP, the engineer or engineering team first defines the problem. Next, the team conducts research into the problem and brainstorms potential solutions. One useful brainstorming technique is an ideation session: a group of individuals come together to create and discuss new ideas. Ideation sessions are used frequently in commercial product design. Five important successful elements of ideation sessions include (Ohler & Samuel, 2013):

- Define the opportunity clearly
- Allow for separate phases of divergent and convergent thinking
- Stimulate thinking inside and outside the box
- Include all problem solving styles
- Ensure an efficient facilitation process for ideation teams

Once the team has developed a solution, they develop a prototype/program and test the solution. Finally, they redesign as necessary or move ahead to present the solution. Failure and redesign is an important component of the engineering design process. For more background on the engineering design process, visit the following sites:

- <http://www.sciencebuddies.org/engineering-design-process/engineering-design-process-steps.shtml>
- <http://www.eie.org/overview/engineering-design-process>
- <https://www.teachengineering.org/engrdesignprocess.php>
- https://en.wikipedia.org/wiki/Engineering_design_process
- <http://curriculum.vexrobotics.com/curriculum/intro-to-engineering/what-is-the-engineering-design-process>

Iconic products are those that are instantly recognized by the consumer and widely regarded as the hallmark of that type of product. An iconic product may, in the mind of the consumer, become almost synonymous with the product in general; for instance, a sneezer frequently asks for a Kleenex instead of a tissue, despite what brand name is on the package.

Symbolism is using an object or other concrete concept to allude to or represent an abstract concept or idea. In this unit, a symbol is a concrete visual image that represents an abstract idea.

Three-Act lessons are a form of teaching mathematics that integrates technology, mathematics and ELA. Dan Meyer is the creator of the Three-Act Lesson and has written a lot about them in his blog: <http://blog.mrmeyer.com/2013/teaching-with-three-act-tasks-act-one/>. The first act is comprised of a video that engages students in a scenario. The first act is very visual and contains very few words/phrases. Its sole purpose is to create dissonance and to have students begin to think of questions they want to answer in the lesson. After students watch the video, they are asked what they wonder and what they notice. Students are then asked to form questions about what they saw. Students are asked to think about the questions their peers have posed and decide if they think they are interesting or not. Students question their peers to consider what a correct answer would be and what an incorrect answer would be. The idea is to increase students' curiosity about what was happening in the video. You have an idea in mind what you want the students to accomplish and they will solve that problem. However, they will ask other questions that you can pursue also. Ask students what was missing in the video clip and what they would add. Guide them to consider what they need to do to solve the problem.

In the Second Act, ask students what they need to solve the problem and allow them to solve the problem. Provide information as needed throughout this section. It is best if that information is provided visually (e.g. images). Bring students together and have them share their solutions.

Act three is the great reveal and extension. Here you can show students the rest of the video that provides them with the answer. Then you can pose an extension task. The idea is that students are motivated to solve challenging problems. Explore Dan Meyer's blog for more detailed information and examples of the Three –Act Lesson Format.

For the module, watch Food Inc. to understand some of the controversy surrounding our food supply.

Be sure to read *Deep Inside Taco Bell's Doritos Locos Taco: From Handshake Deals to Experiments at Home Depot. The History of Taco Bell's Disruptive Faux Cheese-Dusted Taco* by Austin Carr ahead of time so you can be prepared to discuss the Engineering Design Process and Problem Solution Text Structure addressed in this piece. This article can be retrieved from:

<http://www.fastcompany.com/3008346/deep-inside-taco-bells-doritos-locos-taco>

There are many different roles associated with the development, manufacturing, shipping, and display of your favorite snack products. For example, chemical engineers have to consider how the chemistry of the food will interact with the packaging. Mechanical engineers have to develop and modify machines to create the product. Physicists and mathematicians have to explore size, shape, mass, and structure of the products and manufacturing equipment.

You will need to explain the difference between a divergent and convergent ideation session. In this session, you will want to establish some ground rules for “killing” ideas and “pursuing ideas.” More information is provided in the teacher background section on ideation sessions.

ELA Teacher Background Information

- These lessons focus on critical understanding and effective production of a variety of nonfiction/informational texts, including recognition and use of *nonfiction text structures and features*, development and application of *reading comprehension strategies*, and development of *media literacy* skills.
- *Media literacy*: Media literacy refers to the ability to “read” the many messages around us with awareness of how those texts position and potentially affect us. According to the Center for Media Literacy (CML), “*Media Literacy is a 21st century approach to education. It provides a framework to access, analyze, evaluate, create and participate with messages in a variety of forms — from print to video to the Internet. Media literacy builds an understanding of the role of media in society as well as essential skills of inquiry and self-expression necessary for citizens of a democracy.*” (<http://www.medialit.org/media-literacy-definition-and-more>). A central goal of instruction in this unit is for learners to become critical readers and producers of multimedia messages, in particular marketing messages. These lessons focus on developing understanding of media literacy concepts and, with these concepts in mind, learning to approach texts from a critical inquiry stance. The five central media literacy concepts and five related critical questions identified by the CML are woven through the lessons. These concepts and questions, along with additional information, can be accessed at <http://www.medialit.org/reading-room/five-key-questions-form-foundation-media-inquiry>.
- *Nonfiction text structures and features*: Throughout this unit, students will be reading and writing nonfiction/informational texts from a variety of authentic sources and for a variety of purposes. Although nonfiction/informational texts comprise the majority of texts read in secondary schools, in the workplace, and in day-to-day interactions, much early reading instruction tends to focus on reading fiction. Because nonfiction texts are

structured differently and serve different purposes than fictional narrative texts, readers need specific instruction in how to read and compose them. Nonfiction text structures specifically addressed in these lessons are questions and answer and problem and solution. Other common nonfiction text structures include cause and effect, comparison and contrast, description, and sequence. Common nonfiction text features include fonts and special effects (e.g. titles, headings, boldface print, italics, and bullets), textual cues such as “for example,” illustrations and photographs, graphics, and text organizers (e.g. table of contents, glossary, and index.) Teaching students to recognize and use these structures in texts supports their abilities to understand and compose nonfiction texts. For additional information and suggestions for teaching see Stephanie Harvey’s book *Nonfiction Matters* (1998).

- The *reading comprehension strategies* specifically addressed in this unit include determining important information, summarizing, and synthesizing, and questioning—all strategies that are vital for reading the kinds of texts readers will encounter across subject areas: See Harvey & Goudvis (2007), *Strategies that Work: Teaching Comprehension for Understanding and Engagement*, for more information about these and other vital strategies for middle school readers. In addition, teachers should remain cognizant of learner background regarding navigating the Internet safely and productively, teaching and supporting those skills as needed.
- *Flow charts*: The use of flow charts has been shown to be highly effective in supporting diverse learners across content areas. In this lesson, flow charts help students visualize the problem and solution structures imbedded in texts. In this lesson, we introduce the flow chart as a way to graphically represent the structure of a problem-solution article. As students continue in the unit, they will use flow charts to support their own problem-solution text construction. For more information on using flow charts with middle school learners, consult Gore, M. (2010), *Inclusion strategies for secondary classrooms: Keys for struggling learners*.
- It is important to note that these detailed lessons were designed to be used as a guide, rather than a script. The detailed descriptions of questions to ask, explanations to offer, etc. are meant to provide the teacher with a clear view of intention. The authors of this guide recognize the professionalism of each teacher and have confidence in teachers’ abilities to adapt and grow these lessons to fit the needs and interests of their learners.

Lesson Preparation

The lesson launch involves creating a display of a variety of products with various types of packaging.

Also, be prepared for this lesson with pictures of items from the grocery store or local market that students might use on a regular basis and have these available to display as a slideshow.

- Make copies of all student handouts necessary for this lesson
- Have the Engineering Design Process poster ready to share with students.
- Have a sample of Doritos Locos Taco or an image ready to share with students.
- Have paper copies or digital copies of *Deep Inside Taco Bell's Doritos Locos Taco: From Handshake Deals to Experiments at Home Depot. The History of Taco Bell's Disruptive Faux Cheese-Dusted Taco* by Austin Carr. This article can be retrieved from: <http://www.fastcompany.com/3008346/deep-inside-taco-bells-doritos-locos-taco> ready for students to analyze.
- Gather materials for the Design Challenge
- Have the testing station ready to go (including a 5 pound weight)
- Have the three-act lesson cued up.
- Have fictitious chips ready if you have a student with food allergies.
- Have bags of Doritos and paper towels ready for student exploration.
- Have a class chart ready to go or have paper ready for students to construct the chart as a group.
- Have a chart paper ready to record student insights

Learning Plan Components

Introductory Activity/Engagement

Before students enter the room, create a display of products with nested construction, visually engaging packaging, etc.: examples that demonstrate the kinds of product packaging they will seek to create. As much as possible, the items should be showcased for dramatic effect using, for example, labels, lighting, and background music. As students enter the room, welcome them to the Product Pros competition launch. Once students have gathered, invite them to visit the display with the following question in mind: What aspects of the products displayed might make them appealing to a buyer?

Introduce the module challenge by providing the following guide (also found in Appendix A)

PRODUCT PROS COMPETITION GUIDE

Welcome to the Product Pros competition! You have been chosen because of your outstanding job performance and demonstrated potential for excellence in design and marketing. At stake is a bonus salary and the opportunity to work on an exciting new product design campaign. Your challenge is as follows:

Working with a team of your peers, you will redesign a familiar product and create packaging and a marketing campaign, resulting in a hot new product for sale by our company.

YOUR CHALLENGE!

PRODUCT: Choose a familiar product with potential to be redesigned for marketing to a new user, thus expanding the market base and, thus, company revenue. Product parameters:

1. Useful and/or highly appealing to a particular consumer group
2. Fragile enough to need protection during shipping

PACKAGING: Design packaging for both shipping and display. Packaging parameters:

1. Match consumer expectations for the project, yet differentiate itself from similar products
2. Use materials already produced by our company (and, thus, is cost effective)
3. Have a design that is unique and bold in order to attract buyers in the target range
4. Be sustainable
5. Be strong enough to ship and display safely on store shelves

MARKETING: Design a highly effective product logo and multimodal marketing campaign. Campaign parameters:

1. Logo is highly appealing, unique, bold, and memorable in order to attract and retain buyers.
2. The advertisement tells a story, has a focus, and creates a journey that leads the consumer where you want him or her to go.
3. The story of your product is told effectively

PRODUCT TESTING: Test your product for reliability and appeal, and redesign as needed.

Quality parameters:

1. Packaging passes throw, drop, and crush tests designed to demonstrate protection of the product

COMPETITION: Present your product, packaging design, and marketing campaign to a panel of company executives. The presentations will be judged on the following criteria:

- Product selected clearly meets the criteria, and the evidence is clearly articulated in the presentation
- Marketing campaign clearly meets the criteria, and the evidence is clearly articulated in the presentation
- Product testing clearly matches the criteria, and the evidence is clearly articulated in the presentation
- Presenters appear to be well- prepared, speaking clearly and coherently and making eye contact
- Presentation is energetic, creative, and engaging.

Where's My Stuff?

Before you teach this lesson, take pictures of products (students' "stuff") students might use on a regular basis from the grocery store or local market. Hold a class discussion:

- Where would you find this stuff in the store?
- Based on the location of the products in the store what are the store's assumption about you?
- Based on the appearance of the packaging, what are the .

Activity/Investigation

Shipped Chips

Show students a video on how tortilla chips are manufactured and packaged. There are several available on the web to choose from. Here are two examples:

- <https://www.youtube.com/watch?v=QzldZGOR9vo>
- https://www.youtube.com/watch?v=Ylp_zhBIZ7s
- Ask students: *What were some things you noticed about the way the chips were made, packaged, and shipped?* Solicit responses from the question and record those on a class chart. Some additional questions you may ask:
 - *Why did the manufacturer choose to shape the chips that way?*
 - *How were the chips manufactured?*

- *What problems could arise that engineers would have to address in the manufacturing and shipping processes?*
- *What had to be created and designed to make this process work?*
- Explain: *Engineers had to think through this process. They had to design machines and refine the process to make it safe, efficient, and cost effective. Let's think about what went into figuring out how to make these chips.*
- Provide students with the engineering process design graphic and discuss the different components within the context of the video the students watched. There are several available on the Internet, here is one example:
<https://www.teachengineering.org/engrdesignprocess.php>
 - Ask: *What do you think were the needs and constraints that the manufacturers had to confront through the process?*
 - Research/Brainstorm: *What are possible issues and problems the manufacturer would have faced when designing, manufacturing, packaging and shipping their product?*
 - Imagine: As a team, discuss how the manufacturer solved those problems and brainstorm other possible solutions to these problems. Discuss possible alternative solutions as a class.
 - Discuss with students that the next phases of the engineering design process would be to create and build a prototype, test and evaluate said prototype, and improve and redesign as needed.

Three Act Lesson

See Appendix C

Video can be found at: <https://www.youtube.com/watch?v=TbO79YIBu00>

Three act lesson: Act One: Show video of two bags of chips laying on the counter, one small and one large size. Then cut to a young man opening each bag and looking inside and taking a bite from each one.

- Ask students what they notice about the video.
- Ask students what they wonder.
- If students don't ask how many chips are in each bag, ask students: *How many chips are in each bag? Why are the bags so much bigger than each other? Does that mean there are more chips?*
- Ask:
 - *What do you think is an estimate of the number of Doritos that can fit in each bag?*
 - *What is an estimate that will be too big?*
 - *What is an estimate that will be too small?*

Act Two: Act two shows the three bags of Doritos poured out onto paper towels. It also shows a picture of the nutritional information and serving size on the back of each package. Ask students, *how many chips are in each bag?*

- Allow students to solve the problem using methods they find appropriate. Have students share some of their solution strategies as a class. (As students are solving the problem, take notice of students' solutions and be prepared to have students share their findings moving from less sophisticated solutions to more sophisticated solutions.) After you have students share a variety of solution strategies, show connections between the different solution strategies.

Act Three: It actually shows the person counting all of the chips in the bag. But, there are lots of broken chips in the bag.

- Ask students, *What do we count as a full chip? What do we count as a broken chip?*
- *We explored the number of chips in a variety of different sized bags but we ran into a problem. What was that problem?* Solicit information from students.
- *Now we are going to explore the percent of broken chips in each bag.*
- *For our exploration, we need to decide on a common definition of "broken chip."*
- As a class, decide on an acceptable amount of breakage to be considered a full chip. Have students create a graphic showing the various levels of brokenness and how to classify each chip.
- *What are some other things we need to think about?* (Have students think about how to create a whole chip from the broken chips.)
- Group students in teams of 4. Give each student a snack-sized bag of Doritos. Have students empty the contents of their chip bags onto a paper towel. If you have students with food allergies, you may want to choose to create fictitious bags of chips for your students to explore.
- Students will complete the Too Many Broken Chips exploration Sheet (see Appendix D)
- Bring students together and have them discuss their findings and how they computed the average. Did they find the average percent? Did they find the average number using the total? (Clear up any misconceptions the students may have about the average number of broken chips).

Doritos Locos

Ask students if they have ever eaten a Doritos Locos Taco. Bring in sample DLT's or share images of them.

- *Think about the engineering process we discussed yesterday.*
 - *What do you think was the process that Taco Bell had to go through in order to create the DLT?*
 - *What do you think were some problems that they had to address along the way?*
- Write students' ideas up on the board or chart.
- Have students read through *Deep Inside Taco Bell's Doritos Locos Taco: From Handshake Deals to Experiments at Home Depot. The History of Taco Bell's Disruptive Faux Cheese-Dusted Taco* by Austin Carr. This article can be retrieved from: <http://www.fastcompany.com/3008346/deep-inside-taco-bells-doritos-locos-taco>
- As students read, have them write in the margins:
 - What is interesting?

- What do you wonder about?
- What is confusing?
- Students can circle words that they are unsure about so that they can discuss the meaning with their group members (groups of two or three).
- Have students turn and talk to their group members about the article:
 - What is this article about?
 - What happened here?
- Share and discuss as a class.
- Come back as a group to discuss their problem/solution organizers.

Save the Chip Challenge

Ask students: *You explored broken chips – what is an acceptable amount of broken chips in a bag? What were your findings about the percentage of broken chips in your bag?*

Have students share their data. Choose as a class what they believe is an acceptable percentage of broken chips.

Pull up the graphic of the engineering design process. Have students provide examples of what happens at each stage in the process.

Pose the problem: *You have received letters from numerous customers complaining that your bags of chips have too many broken chips inside of them. Your job is to correct the problem. Here is your desired outcome: Using the engineering design process, your group will design a container that will protect your chips from being broken when dropped from 5 feet, thrown 5 feet and when a 5 pound weight is placed on top of the container.*

You will only have the following materials in which to create a prototype of your container:

Cardboard

Duct tape

Plastic Storage Bags

Popsicle sticks

3 sheets of paper

2 bags of chips for trial runs (plus 1 for your final test)

Your group will use the engineering design process to create and test your container.

Establish safety parameters to avoid behaviors such as students throwing chips at each other.

After students complete the challenge, hold the throw test, crush test, and drop test. The team with the least amount of broken chips wins the competition. Discuss the design features of each packaging solution.

Discuss how students used the engineering design process to solve a real world problem.

Message on a Bottle: How Product Marketers Try to Reach you from the Shelf

Display an image of a message in a bottle while you play Sting's song "Message in a Bottle" and examine the lyrics. What is this idea of a message in a bottle? Bring discussion around to the idea that someone is sending out a message in hopes that others will pick it up and do something in response and that the message isn't sent directly to any one person. While not as poignant, marketers do basically the same thing: they send a message about their products out into the world hoping that someone will pick up that message and buy the product. Just like a "message in a bottle," this "message on a bottle" (or can or box or...) must be brief yet effective, able to communicate across time and space to reach a likely responder.

- View and discuss "The Basic Function of All Packaging" video from the "Media Bistro" (<http://www.mediabistro.com/Whos-the-Package-For-Secrets-of-Packaging-Design-286-ondemandvideo.html#viewer>). Talk together about the ways manufacturers might design packages to appeal to certain kinds of people. Record student ideas on a chart or other display medium.
- Divide students into small groups and give each group several product packages to analyze. Students will examine the packaging carefully for "messages" about intended use and appeal. Questions to consider include, "What are the messages the manufacturer is trying to send to the consumer regarding what the product is for and the quality and appeal of the product? To what sorts of consumers does the marketer seem to be aiming the message? How is the marketer using language (word choice, phrasing, etc.) and visual imagery to entice and position the consumer? Share and discuss findings.
- Introduce the concepts of *demographics*. Just like the message in the bottle cannot be sent to one particular user, so marketers conceptualize a type of person who might be likely to buy a product based on group characteristics. These broad categories describing people are called demographics. Common demographic categories include age, ethnicity/culture, education level, household composition (married? with children?), and professional/employment status. Discuss each briefly to make sure learners understand what each entails.
- Explain that each demographic indicator has a potential effect on purchasing choices. The teacher can provide examples of the effect of each by giving an example of how his or her demographic positioning affects what he or she buys.
- Have students choose one package from those provided and try to "construct" the targeted consumer through demographic indicators. Working in pairs or small groups, students should consider the basic demographic indicators and other buying factors. Have students share their ideas about the target consumer with the class. Use these questions as a guide:
 - What is the age of your targeted consumer?

- What is the gender of your targeted consumer?
- In what kind of family does your targeted consumer live? What role does your consumer play in the family?
- What is the cultural identity (or identities) of your consumer? (Consider ethnicity, religion, etc.)
- What is this person's available income and what sort of control does this person have over the spending?
- What does this person like to do?
- What else do you need to consider?

Product Pros

By the end of this lesson, students should be grouped into their Product Pros teams and will begin to choose their product for the Product Pros challenge.

Explain

You will need to explain the engineering design process graphic to students.

You may wish to introduce career connections to students. There are many different roles associated with the development, manufacturing, shipping, and display of your favorite snack products. For example, chemical engineers have to consider how the chemistry of the food will interact with the packaging. Mechanical engineers have to develop and modify machines to create the product. Physicists and mathematicians have to explore size, shape, mass, and structure of the products and manufacturing equipment.

You may need to conceptually develop the method for finding the average by providing students with connecting cubes and have them create a bar graph of the data. Then, have students level the bars. Ask students to try to write how this would look if we were to use number sentences. Ask students how they could write a formula for finding the arithmetic mean (average) for any set of numbers. Provide students with the following method for finding the arithmetic mean if they do not develop it.

$$\text{arithmetic mean} = \frac{a_1 + a_2 + a_3 + \cdots + a_n}{n}$$

Extend/Apply Knowledge

You may wish to schedule a field trip to a local grocery store to make observations about product placement, packaging, and other marketing techniques employed by manufacturers and retailers.

Assessment

Performance Tasks

- Too Many Broken Chips sheet
- Saving the Chip Challenge Competition Rubric (Rubric 2, Appendix B)

Other Measures

- Participation in Message in a Bottle target market activity

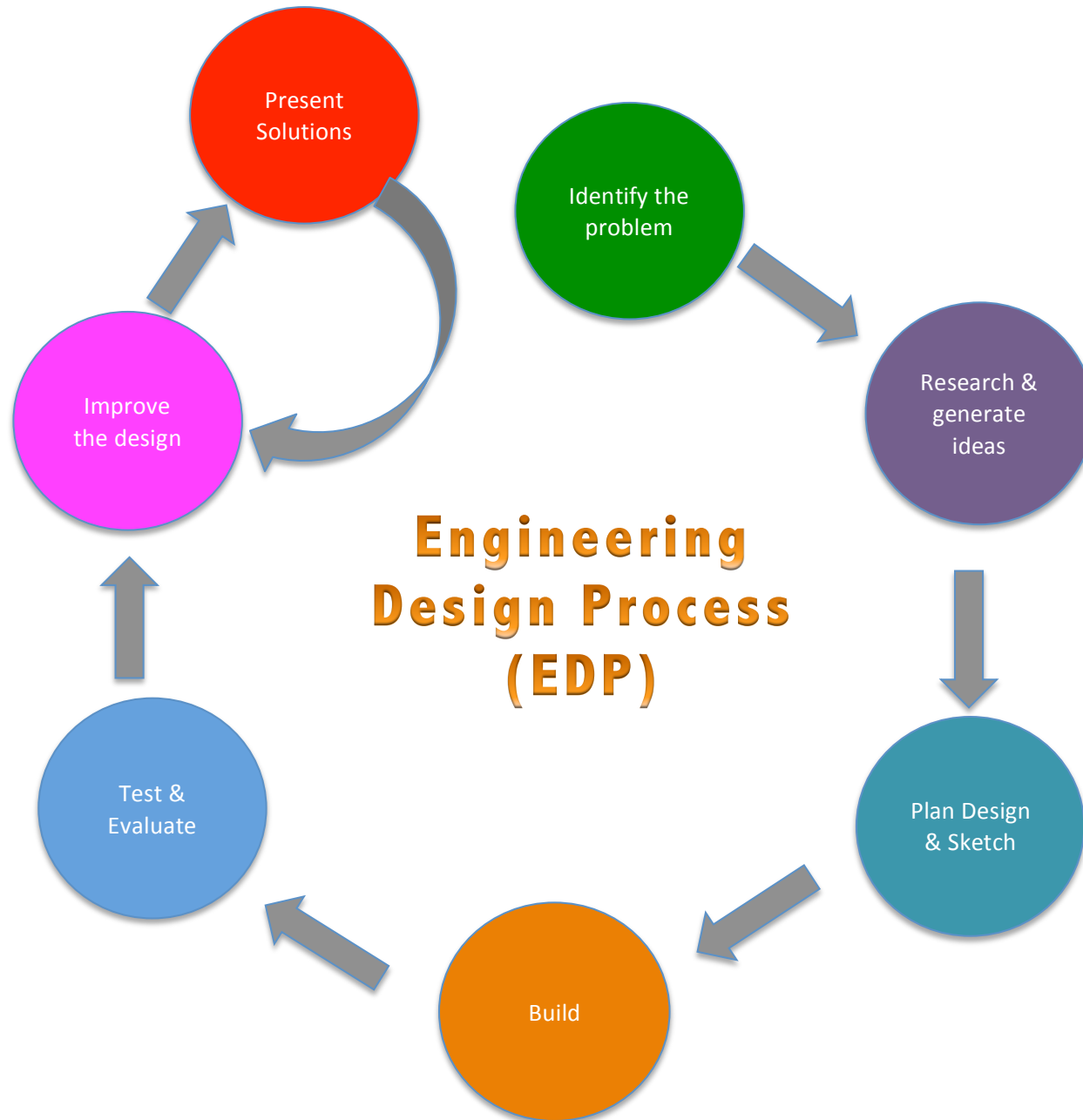
Internet Resources

These website provides some important information on food deserts and swamps:

- <http://mic.com/articles/7176/obesity-food-deserts-have-given-way-to-food-swamps>
- <http://voices.washingtonpost.com/all-we-can-eat/food-politics/food-deserts-vs-swamps-the-usd.html>
- <http://brownisthenewpink.com/2014/05/27/food-deserts-and-swamps-social-justice-issue/>

Annenberg Learner (<http://www.learner.org/>) is an excellent resource for teaching across content areas. For specific enrichment related to reading and writing nonfiction, explore the following:

- Teaching Reading 3-5: Summarizing Nonfiction (adaptable to upper grades) at <http://www.learner.org/workshops/teachreading35/classrooms/cv8.html>
- Reading and Writing in the Disciplines: Organizing Information from Multiple Sources at <http://www.learner.org/courses/readwrite/video-detail/organizing-ideas-multiple-sources.html>
- Teaching Content Through Literacy: <http://www.learner.org/courses/readwrite/video-detail/teaching-content-through-literacy.html>
- Writing Across the Curriculum at <http://www.learner.org/workshops/writing35/index.html>



Lesson Plan #2

Represented World Communication – 6th Grade

Lesson Title: The Packaging

Lesson Summary

In this lesson, students will continue to prepare for their design challenge by building background knowledge required to complete the project. Students will explore three-dimensional shapes and calculate surface area and volume. They will develop an understanding of packaging materials and discuss the sustainability of those materials. Students will repurpose their product's packaging and prepare for the marketing pitch for their final challenge. Options for this lesson include inviting a guest speaker from a local manufacturer to discuss packaging and sustainability issues or taking a field trip to a local manufacturer to observe the process of packaging on the factory floor.

Essential Question(s)

- How are engineering design skills and communication skills employed in the design and marketing of consumer products?
- Where do packages and products originate and how can manufacturers make sure that their products and packaging are sustainable?
- How is surface area and volume used in order to create packaging?
- How might different people understand and respond to media messages differently?

Established Goals/Objectives

Students will be able to:

- Understand that companies create, design, and market products purposefully, targeting to specific audiences to maximize profits.
- Understand how surface area and volume are used in packaging and manufacturing.
- Calculate surface area and volume of three-dimensional figures and develop a general formula.
- Develop fluency through preparing and performing commercial scripts
- Select and use a variety of media (print, art, video, etc.) to communicate complex information
- Use oral and written language effectively to collaborate and problem solve in a work community context

Time Required

2 days (90 minutes each)

Necessary Materials

- Packages in a variety of three-dimensional shapes (3 – 5 per group of 3 students):
 - Oatmeal canister, cereal boxes, bottles with labels, cans (soup, tuna), shoe boxes, other food containers (spaghetti, mac n cheese, toilet paper, paper towels, candy containers, take out containers) in a variety of shapes (e.g. cylinders, cubes, prisms, spheres, pyramids)
- Chart paper
- Computer/Tablets/Laptops for student research
- Projector
- Markers
- Post-it Notes

Standards Addressed in STEM Road Map Module Lesson

Next Generation Science Standards

MS-ETS1-1

MS-ETS1-2

MS-ETS1-3

MS-PS1-3

MS-ESS3-3

Common Core Mathematics

Math Practices

- MP1. Make sense of problems and persevere in solving them.
- MP3. Construct viable arguments and critique the reasoning of others.
- MP4. Model with Mathematics
- MP5. Use appropriate tools strategically.
- MP6. Attend to Precision

Content Standards:

- Content.6.RP.A.3.C.
- Content.6.SP.A.1
- Content.6.SP.A.3
- Content.6.SP.B.5.B
- Content.6.SP.B.5.C

Common Core ELA

- CCSS.ELA-LITERACY.RH.6-8.4
- CCSS.ELA-LITERACY.RI.6.2
- CCSS.ELA-LITERACY.RI.6.6
- CCSS.ELA-LITERACY.W.6.4
- CCSS.ELA-LITERACY.W.6.6
- CCSS.ELA-LITERACY.WHST.6-8.4
- CCSS.ELA-LITERACY.WHST.6-8.6

- CCSS.ELA-LITERACY.WHST.6-8.8
- CCSS.ELA-LITERACY.WHST.6.10

21st Century Skills

21st Century Skills:

- Environmental Literacy
- Health Literacy
- Global Awareness
- Financial, Economic, Business, and entrepreneurial literacy
- Civic Literacy

Learning and Innovation Skills:

- Creativity and Innovation
- Critical Thinking and Problem Solving
- Communication and Collaboration

Information, Media and Technology Skills:

- Information Literacy
- Media Literacy
- ICT Literacy

Life and Career Skills:

- Flexibility and Adaptability
- Initiative and Self-Direction,
- Social and Cross Cultural Skills,
- Accountability, Leadership, and Responsibility

Key Vocabulary	Definition
Efficient	Achieving maximum results with minimum effort.
Sustainability	“Sustainability could be defined as an ability or capacity of something to be maintained or to sustain itself” (LandLearn NSW, ND).
Environment	The natural world, as a whole or in a particular geographic area, especially affected by human activity.
Sustainable packaging practices	Packaging practices that have a minimal impact on the environment.
Recyclable	Convert into usable material
Packaging	The container or wrapper that holds a product or group of products.
Environmental stewardship	The responsible use and protection of the natural environment through conservation and sustainable practices.
Packaging lifecycle	Packaging development and decomposition from raw materials to landfill or recycled purpose
Surface area	Measure of the total area that the surface of an object occupies.
Volume	The amount of three-dimensional space an object occupies.

Demographics	The statistical data of a population, especially those showing average age, income, education, etc.
Properties of shapes	A property is a character or quality that a shape has.
Net	The pattern that you can cut and fold to make a model of a solid shape.
Geo-marketing	Integration of geographical intelligence into various aspects of marketing, including sales and distribution.
Landfill	A system where waste materials are buried under the ground.
Bioplastic	A substance made from organic biomass sources.
Repurpose	To change to use for a different purpose
Three-Dimensional	An object that has height, width, and depth.
Line of Symmetry	The imaginary line that shows where you can cut a figure into halves that will be mirror images of each other.
Plane of Symmetry	The imaginary plane that shows where you can cut a three-dimensional shape in halves that will be mirror images of each other.
Social Justice	Promoting a just society by challenging injustices and valuing diversity. It is a belief that we are all humans and thus have a right to just treatment, fair pay, equitable allocation of resources, and support of human rights.
CEO	Chief Executive Officer

Teacher Background Information

In this lesson, students will be learning about packaging, surface area, volume, and sustainability issues associated with packaging. The following information and links will help the teacher engage his/her students in this lesson:

- What is sustainability? According to LandLearn NSW (N.D.), sustainability is the “ability and capability of something to be maintained or to sustain itself. It’s about taking what we need to live now, without jeopardizing the potential for people in the future to meet their needs.” The concept of sustainable packaging is a growing concern around the globe as the number of people on our planet rises. According to the Sustainable Packaging Coalition (2011), sustainable packaging:
 - Must be safe and healthy for individuals and communities throughout its lifecycle.
 - Must meet market criteria for performance and cost
 - Is sourced, manufactured, transported, and recycled using renewable energy.
 - Optimizes the use of renewable or recycled source materials.
 - Is manufactured using clean production technologies and best practices.
 - Is made from healthy materials throughout the lifecycle
 - Is physically designed to optimize materials and energy
 - Is effectively recovered and utilized in biological and/or industrial closed loop cycles.

Sustainable packaging provides opportunities for manufacturers, shipping companies, and individuals to preserve our environment. The following websites will provide teachers with information about sustainability and sustainable packaging.

- <http://www.landlearnsw.org.au/sustainability/what-is-sustainability>
- <http://sustainablepackaging.org/uploads/Documents/Definition%20of%20Sustainable%20Packaging.pdf>
- <http://www.packworld.com/design/sustainability>
- <http://www.theguardian.com/sustainable-business/2014/jul/18/good-product-bad-package-plastic-recycle-mistakes>
- When companies in the United States and other developed countries outsource manufacturing jobs to developing countries, they often bring jobs and resources with them. These jobs and their infrastructure can be a big boost for the economy of the developed country and can mean big profits for the company.
- While we have described some of the benefits of outsourcing to the company and the host country, there are negative implications of outsourcing for the host country as well. Manufacturing waste, low wages, poor living conditions, and poor working conditions are just a few of the issues that can plague companies that outsource jobs. Responsible business practices are a must in today's global society. Here are a few websites to help the teacher learn more about issues of manufacturing and outsourcing:
 - <http://www.chinalaborwatch.org/report/52>
 - <http://www.globalexchange.org/fairtrade/sweatfree/faq>
 - <http://www.theguardian.com/commentisfree/2013/apr/29/bangladesh-factory-tragedy-sweatshop-economics>
 - <http://www.crf-usa.org/bill-of-rights-in-action/bria-17-2-c-globalization-and-worker-rights>
 - <http://www.slideshare.net/anilsural/is-outsourcing-exploitation-or-chance-for-developing-countries>

Lesson Preparation

- Gather a variety of packaging types (tetra pak, Bioplastic, plastic, paper, cardboard, etc....).
- Gather a variety of packages in various three-dimensional shapes.
- Plan for guest speaker or field trip (see Extend/Apply).

Learning Plan Components

Introductory Activity/Engagement

Show students a video from UPS on sustainable packaging.

<https://www.youtube.com/watch?v=zX5mA3f7Yms>

- Have students write down any words that they feel are important to discuss.
- After the video, have them turn and talk and share their list of words with their partner.
- Ask several students to share their list and add it to the class chart. As students share a word, have them define it in their own words. (Students should mention terms such as efficient, sustainable, environment, sustainable packaging practices, recyclable, reusable, packaging, shipping, sustainable packaging, and environmental stewardship).

Pose the following question: *Is it important to produce recyclable packaging? How do we know if a package is recyclable?*

Explain the following:

According to the Sustainable Packaging Coalition, sustainable packaging:

- Must be safe and healthy for individuals and communities throughout its lifecycle.
- Must meet market criteria for performance and cost
- Is sourced, manufactured, transported, and recycled using renewable energy.
- Optimizes the use of renewable or recycled source materials.
- Is manufactured using clean production technologies and best practices.
- Is made from healthy materials throughout the lifecycle
- Is physically designed to optimize materials and energy
- Is effectively recovered and utilized in biological and/or industrial closed loop cycles.

Ready, Aim...Youth as the Target of the Market

- Draw or display a target with a human figure at the center along with the words, "You are a target in the market." Review the "Where's My Stuff" engagement activity at the beginning of the module (or the grocery store field trip), discussing together how we identified the items that were marketed to us. (Students might address interests, societal gender marks such as color of the product and/or on the packaging, images (e.g. pictures of girls or boys), etc. Explain that marketers purposefully try to interest young buyers in their products.
- Ask, "Why might that be, given that young people rarely have good paying jobs or a full say in what gets purchased?" Have students work in pairs to brainstorm reasons they might be valued targets for marketers. Returning to a whole group setting, invite students to share ideas that they generated. Record their ideas in a displayed document or on a chart.

- Display the article information about youth marketing from Marketing-Schools.org <http://www.marketing-schools.org/types-of-marketing/youth-marketing.html> and provide students with access to individual copies. Explain that this website is targeted to individuals who are interested in a career that involves marketing products to consumers. If technology allows, give students time to explore the website a bit to get a better sense of the purpose it serves. Highlight the concept of audience, making sure that readers understand that the authors aren't writing for them, but rather for people who want to sell to them.
- Go back to the question of why marketers are interested in targeting sales to youth. Ask readers to start with that question in mind as they listen to you read the introductory paragraph aloud. After reading the first paragraph, ask students to confer with a partner to identify and mark (either by highlighting or using an electronic post it on a web text or using a paper post-it or penciled asterisk on a paper text) one or two important ideas from that paragraph.
- Invite a couple of pairs to share their important ideas; as they do, mark these ideas on the displayed article. Discuss why they think these ideas are important and/or interesting. Does the paragraph give any insights into their initial question? If so, what? What else are they wondering now about marketing?

Activity/Investigation

Shape Show

Have a three-dimensional image ready to show students (hide it so they can't see it just yet). Tell them they will have three seconds to view the object and will have to draw what they saw. (Be sure to only give them three seconds so they have to develop mental images). After students create their drawings, tell them you will give them a second look and allow them to refine their drawings.

- Ask students to share the answers to the following questions:
 - *What did you see?*
 - *How did you see it?*
 - *What did you draw first? Why?*
 - *What did you draw next?*
 - *How else did you see it?*
 - *How do you know that is a (right angle, circle, rectangle, rhombus, etc....)*

These questions will vary based upon the image you choose.
- *What are the properties of this shape?*
- *Are there other shapes that have the same properties? Where do you see these shapes in your daily life?*
- Hand out the various shaped packages (3 to 5 per group) to each group. Oatmeal, cereal boxes, bottles with labels, Cans, Shoe boxes, Food containers (spaghetti, mac n Cheese, toilet paper, paper towels, candy containers, take out containers, Make each group has a variety of shapes (e.g. cylinders, cubes, prisms, spheres, pyramids).

- *With your partners, explore the shape of the package. Students should:*
 - Estimate how much material would be needed to create these packages.
 - Decide how they might find the total area of the surface of a three-dimensional figure. This is called surface area.
- *Ask: How do you think these packages would be shipped in bulk to the store? Discuss nested packaging with the students. How many of _____ would fit in a box _____ size? What about this shape? Why do you think they ship them this way?*

Optional group activity

Present students with the following scenario and have students work in groups to create solutions:

Ace packaging created a package with a volume of 24 cubic inches. However, in their description to the manufacturer, they forgot to tell them what the shapes dimensions and shape were. Help the manufacturer out by creating as many packages as you can with this volume. Determine the surface area of your packages as well so that you know how much material to order.

Product Pros

Students should continue finalizing their ideas for the product they will package and market in the Product Pros challenge.

Explain

Students should have a basic understanding of calculating volume and surface area. The following video briefly outlines procedures for finding the surface area of 3-dimensional shapes: <https://www.youtube.com/watch?v=yTD6EsYMSOw>.

The National Council of Teachers of Mathematics provides an isometric drawing tool at <http://www.nctm.org/classroom-resources/lessons/Finding-Surface-Area-and-Volume/> that may be useful to students.

Extend/Apply Knowledge

- You may wish to invite a guest speaker from a local manufacturing company to discuss their packaging and sustainability practices.
- You may wish to schedule a field trip to a local manufacturing plant to observe packaging on the factory floor.

Assessment

Performance Tasks

Shape Show participation, drawing, calculations

Other Measures

Participation in group activities

Internet Resources

The Center for Media Literacy website is an outstanding source for teachers at all levels and across disciplines. Of particular interest to middle school teachers is the section on Media Literacy in the Middle School found at <http://www.medialit.org/reading-room/media-literacy-middle-school>

The National Writing Project provides a wide range of resources to support the teaching of writing, including a number related directly to argumentative and persuasive writing. See http://www.nwp.org/cs/public/print/resource_topic/teaching_writing for a topical directory.

Social Justice for Kids: These websites provide some important information for teachers about how to teach children about social justice.

- Reach and Teach: This site defines social justice and provides some resources for teachers. <http://www.reachandteach.com/content/index.php?topic=socialjustice>
- Ten Social Justice Activities to Try: This site offers activities for elementary and middle grades students to teach about social justice. http://www.educationworld.com/a_lesson/social-justice-activities-students.shtml
- Resources for Social Justice: This site provides teachers with lesson ideas, children's literature connections, and other resources for teaching social justice: http://www.arteducators.org/news/national-convention/Sarah_Ryder_Using_Children%E2%80%99s_Literature_to_Teach_Ideas_of_Social_Justice.pdf

Lesson Plan #3
Represented World Communication – 6th Grade

Lesson Title: Product Pros

Lesson Summary

In this lesson, students continue to explore how marketing impacts them as consumers. Students will work in groups to design present their product packaging and the marketing plan (logo design and advertisement) for their product.

Essential Question(s)

- How do companies create, design, and market products purposefully for a specific audience to maximize profits?
- How can we create a package that will keep a product safe during transport and be appealing to consumers?
- How can we create marketing materials that will encourage consumers to buy our product?

Established Goals/Objectives

Students will be able to:

- Understand that companies create, design, and market products purposefully, targeting specific audiences to maximize profits.
- Understand that marketing is a complex process that requires feedback from a target audience and revisions as needed.
- Understand that media messages are constructed using a creative language with its own rules and, when engaging with a media message, consider what techniques are being employed to attract buyer attention
- Understand that different people experience the same media message differently, and consider their own stances and how others might view it differently.
- Select and use multiple forms of media (visual and textual) to convey information about a product and persuade an audience to buy it.

Time Required

4 days (90 minutes each)

Necessary Materials

- Computer/Tablets/Laptops for student research
- Projector
- Poster board (2 pieces per 3 students)
- Markers (1 set per 3 students)
- Cardboard (2 pieces approximately 12 x 12 per 3 students)
- Clear tape (1 per 3 students)
- Duct tape (1 per 3 students)
- Scissors (1 per 3 students)
- Glue (1 per 3 students)
- Staplers (1 per 3 students)
- Staples
- Clear plastic storage bags (gallon size – 3 per 3 students)

Standards Addressed in STEM Road Map Module Lesson

Next Generation Science Standards

MS-ETS1-1

MS-ETS1-2

MS-ETS1-3

MS-LS1-1

MS-LS1-3

Common Core Mathematics

Math Practices

- MP1. Make sense of problems and persevere in solving them.
- MP3. Construct viable arguments and critique the reasoning of others.
- MP4. Model with Mathematics
- MP5. Use appropriate tools strategically.
- MP6. Attend to Precision

Content Standards:

- Content.6.RP.A.2
- Content.6.RP.A.3
- Content.6.EEA.2
- Content.6.EEB.6
- Content.6.SP.A.1
- Content.6.SP.A.3
- Content.6.SP.B.5

Common Core ELA

- CCSS.ELA-LITERACY.RH.6-8.4
- CCSS.ELA-LITERACY.RI.6.2

- CCSS.ELA-LITERACY.RI.6.6
- CCSS.ELA-LITERACY.W.6.4
- CCSS.ELA-LITERACY.W.6.6
- CCSS.ELA-LITERACY.WHST.6-8.4
- CCSS.ELA-LITERACY.WHST.6-8.6
- CCSS.ELA-LITERACY.WHST.6-8.8
- CCSS.ELA-LITERACY.WHST.6.10

21st Century Skills

21st Century Skills:

- Environmental Literacy
- Health Literacy
- Global Awareness
- Financial, Economic, Business, and entrepreneurial literacy
- Civic Literacy

Learning and Innovation Skills:

- Creativity and Innovation
- Critical Thinking and Problem Solving
- Communication and Collaboration

Information, Media and Technology Skills:

- Information Literacy
- Media Literacy
- ICT Literacy

Life and Career Skills:

- Flexibility and Adaptability
- Initiative and Self-Direction,
- Social and Cross Cultural Skills,
- Accountability, Leadership, and Responsibility

Key Vocabulary	Definition
Average order	The mean number of items ordered from a company.
Constrict	To draw or press in; cause to contract or shrink, compress.
Correlation	Mutual relationship of two or more things
Economic Downturn	"A drop or reduction in the success of a business or economy" (Freedictionary.com, 2003).
Economic interdependence	"A consequence of specialization, or the division of labor, and is almost universal. The participants in an economic system are dependent on others for the products they cannot produce efficiently for themselves. This physical interdependence implies corresponding linkages in the demands for products and the incomes of the participants" (Wikipedia, n.d.b).

Key Vocabulary	Definition
Economy	"The management of the resources of a community, country, etc., especially with a view to its productivity."
Emerging markets	"A country that has some characteristics of a developed market, but does not meet standards to be a developed market. This includes countries that may be developed markets in the future or were in the past" (Wikipedia, n.d.c).
Exports	Shipping the goods and services out of the port of a community.
Fair Trade	"A social movement whose stated goal is to help producers in developing countries achieve better trading conditions and to promote sustainability. Members of the movement advocate the payment of higher prices to exporters, as well as higher social and environmental standards" (Wikipedia, n.d.a).
Free trade	"A system of trade between nations in which there are no special taxes placed on imports" (http://www.merriam-webster.com/dictionary/free%20trade).
Global Market	"The process of conceptualizing and then conveying a final product or service worldwide with the hopes of reaching the international marketing community" (businessdictionary.com).
Global Reach	When a business seeks to develop their client base by using the Internet.
Gross Profit	Gross receipts less the cost of goods or production but before the deduction of such other costs as rent or salaries.
Immune Response	Any of the body's immunologic reactions to an antigen
Imports	A commodity, article, or service brought in from abroad for sale.
Marketing	The process of planning and executing the conception, pricing, promotion and distribution of ideas, goods and services to create changes that satisfy individual and organizational objectives.
Marketing Costs	The amount of money a company or individual spends to market its products.
Metrics	The measures used in marketing.
Misleading statistics	Statistics that are used incorrectly or to misinform the population.
Needs	A necessity. Something we need to survive and thrive.
Packaging	What the package the product is in looks like, the information provided and how it is presented at the place of purchase
Positive Association	A positive feeling one receives when seeing, hearing, tasting, or feeling a familiar product, image, or song.
Price	An amount of money that the customer has to pay.
Product	Product - A good or service a company makes in quantity to sell on the open market.
Product benefit	Perceived benefit to the customer
Product	Something that makes a product different to the consumer than other

Key Vocabulary	Definition
Differentiation	similar products.
Product Features	Characteristic that the product may have.
Replicate	To make a copy of itself.
Return on Investment	The amount of profit, before tax and after depreciation, from an investment made, usually expressed as a percentage of the original total cost invested.
Return rate	The percentage of people who became customers from a potential customer pool.
Revenue	The amount of money regularly coming in to a company.
Statistics	"The science that deals with the collection, classification, analysis, and interpretation of numerical facts or data, and that, by use of mathematical theories of probability, imposes order and regularity on aggregates of more or less disparate elements" (Dictionary.com, 2005c).
Target Audience	The customers who are most likely to buy the product.
Virus	An ultramicroscopic, metabolically inert, infectious agent that replicates only within the cells of living hosts, mainly bacteria, plants, and animals; composed of an RNA or DNA core, a protein coat, and, in more complex types, a surrounding envelope.
Wants	Something demanded, desired, or required.
World Market	"The aggregate of all national markets, seen as linked through mutual economic and trade relations" (http://encyclopedia2.thefreedictionary.com/World+Market).

Teacher Background Information

Students will create logos for their products during this lesson. There are a number of websites that show a wide range of logos. One interesting one, including not only a visual overview of logos but also some discussion about the meaning of each, can be found at <http://www.mangoshock.com/famous-logos-that-have-a-hidden-message/>. Of course, you will need to preview sites and consider appropriateness of various products for your audience.

Lesson Preparation

Search the Internet for product logos to provide as examples to students..

Assemble materials students will use to create their product's packaging.

Decide on parameters for students' advertisements (i.e., narrated PowerPoint presentations, video recorded live action, etc.) and have appropriate technology on hand.

An option for this lesson is to invite outside guests to act as "judges" for students' packaging and marketing materials.

Learning Plan Components

Introductory Activity/Engagement

Present the following scenario to students: *You want to go outside to play but your parents tell you it is too cold to go outside, saying “You will catch a cold.” Does being cold make you catch a cold? Why? Why not?*

Have students who think they will catch a cold from being cold move to one side of the room. Have students who believe that being cold doesn’t make them catch a cold move to the other side. Pose the question to students; *What is a snake oil salesman?*

- Show students a clip from the following video:
<https://www.youtube.com/watch?v=QHboMLW-Zn0>
- Ask: *Do you think his claims that the ointment cures disease is true?* What evidence does he provide that it works and how do we know he is telling the truth?
- Show students the following video on the history of snake oil salesmen:
 - <https://www.youtube.com/watch?v=titzrDTfp70>
- Explain that the Federal Trade Commission enforces laws that prohibit advertisers and marketers to lie about its products. When the FTC finds a false claim, they file an action in federal district court. If companies are found guilty of violating laws, they usually are required to cease and desist the marketing campaign and change their labels. They also are often fined a large sum of money and required to make it right to the consumer some how. (Refunds, cash settlement, etc.....)

Show students an animation or video that discusses the issue of whether or not the cold makes you sick. An example is located at:

<https://www.youtube.com/watch?t=10&v=RWiOhlqEDz4> . Now revisit the question of whether going outside into cold weather can cause a cold. Have students change their answers if they wish.

Ask students how the message from their parents about the cold weather causing colds might be similar to marketing messages they hear on TV or the radio. Ask:

- *What role does media play in distributing ideas about science?*
- *How does social media play into this?*
- *What about the spreading of false science or misconceptions?*

Activity/Investigation

Marketing Mania

- Display one of the short commercial scripts available from Interactive Voices Inc. (<https://www.voices.com/resources/scripts>). Read it aloud, modeling the prescribed delivery, then call student attention to the casting, target, and delivery suggestions

provided. Discuss how the target market may have affected marketer decisions about the tone and content of the ad.

- Provide additional examples from the same site and have students try out the delivery of the commercial messages following the suggestions provided. Consider having students work in pairs to practice and deliver the commercial scripts, then having the rest of the group guess the target demographic.
- Remind students that all media messages are constructed and that the person constructing the message has a goal in mind for that message. With commercials, the goal is to sell the product to a targeted market.
- Give students access to the article from the U.S. Small Business Administration on how to design advertising for your product. <https://www.sba.gov/content/advertising-basics>, explaining that this is an informational text produced to inform advertisers about how to construct an effective advertising campaign. Review strategies addressed so far for reading informational texts, discussing intended audience and structure of the article (and how that structure can help them comprehend the article).
- Show students examples of well-known logos to see how quickly they can identify the company and product. Explain that a logo is a constructed symbol that stands for a company's product.
- Engage students in exploring a variety of logos together. Discuss how marketer decisions such as use of color (e.g. bold and energizing or soft and soothing?) and line (thick or fine, curvy or blocked, etc.) seem to fit with the product image they want to convey. Discuss why some particularly well-known companies might not have text incorporated into their logos.
- A well-designed logo will communicate and appeal to target consumers. Most effective logos include simple text that identifies the company, color that is eye-catching and appealing, and a simple graphic design that is easily recognizable and easy to

Product Pros

Tell students that from now until the end of the module they will be working on their Product Pros challenge. Review the Product Pros challenge handout from Lesson 1 with students and remind them that they should use the EDP as they create their packaging and marketing materials. Remind students that they will need to:

- ✓ Choose a product that they wish to create packaging for
- ✓ Decide on the target audience for the product/marketing materials
- ✓ Create a package that can withstand transportation (throwing, dropping, crushing) and that will be appealing to the consumer
- ✓ Create a logo for their product (this should be included in the packaging and on a separate piece of paper)
- ✓ Create an advertisement for their product

After students have completed their Product Pros work, test all packaging (throw, drop, crush) and have students present their packages and marketing materials (logo and advertisement) to the class and any other invited guests.

Explain

Explain that marketers use metrics to determine how effective their marketing practices are. You may wish to introduce the following vocabulary:

- Marketing Return on Investment:
- Gross Profit
- Marketing investment
- Investment
- Revenue

Extend/Apply Knowledge

Option: Invite outside guests to act as the audience for students' product package presentations and advertisements.

Assessment

Performance Tasks

- Product Pros Challenge products (See Appendix B, Rubric 1)

Other Measures

- Collaboration/participation in team activities

Internet Resources

- A Simple Explanation of the Math Behind 7 Common Marketing Metrics: <http://blog.hubspot.com/marketing/math-behind-common-marketing-metrics> This website shares some important information on how marketing professionals use mathematics in their daily jobs.
- Wikipedia Information on the World Economy: https://en.wikipedia.org/wiki/World_economy This site contains information on the world economy.
- Fair Trade USA: <http://fairtradeusa.org/products-partners/cocoa> This site provides information on Fair Trade practices in the USA.
- Seven Ways to Create a Successful Marketing Campaign: <http://www.cio.com/article/2377257/online-marketing/7-ways-to-create-a-successful-integrated-marketing-campaign.html> This site provides some marketing strategies that you can share with your students.
- Misleading Statistics: <http://www.truthpizza.org/logic/stats.htm> This site provides some important teacher information on misleading statistics.
- Statistics can be Misleading: <http://www.econoclass.com/misleadingstats.html> This site provides some real-world examples of misleading statistics.
- Introducing Ghana: <http://www.lonelyplanet.com/ghana> Introducing Ghana provides teachers with images, cultural information, and travel guides so that they can help students understand more about Ghana.
- Ghana: <http://www.everyculture.com/Ge-It/Ghana.html> Every Culture provides a wide variety of information about the history and culture of Ghana.
- Four Secrets to Giving a Great Marketing Presentation: <http://www.entrepreneur.com/article/234832> This site offers some information that you can share with your students about how to give a great marketing presentation.
- Vital Tips for Effective Logo Design: <http://www.smashingmagazine.com/2009/08/vital-tips-for-effective-logo-design/> Jacob Cass provides some important information on Logo design on this website.

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Appendix A
PRODUCT PROS COMPETITION GUIDE

Welcome to the Product Pros competition! You have been chosen because of your outstanding job performance and demonstrated potential for excellence in design and marketing. At stake is a bonus salary and the opportunity to work on an exciting new product design campaign. Your challenge is as follows:

Working with a team of your peers, you will redesign a familiar product and create packaging and a marketing campaign, resulting in a hot new product for sale by our company.

YOUR CHALLENGE!

PRODUCT: Choose a familiar product with potential to be redesigned for marketing to a new user, thus expanding the market base and, thus, company revenue. Product parameters:

3. Useful and/or highly appealing to a particular consumer group
4. Fragile enough to need protection during shipping

PACKAGING: Design packaging for both shipping and display. Packaging parameters:

6. Match consumer expectations for the project, yet differentiate itself from similar products
7. Use materials already produced by our company (and, thus, is cost effective)
8. Have a design that is unique and bold in order to attract buyers in the target range
9. Be sustainable
10. Be strong enough to ship and display safely on store shelves

MARKETING: Design a design a highly effective product logo and multimodal marketing campaign. Campaign parameters:

4. Logo is highly appealing, unique, bold, and memorable in order to attract and retain buyers.
5. The advertisement tells a story, has a focus, and creates a journey that leads the consumer where you want him or her to go.
6. The story of your product is told effectively

PRODUCT TESTING: Test your product for reliability and appeal, and redesign as needed.

Quality parameters:

2. Packaging passes throw, drop, and crush tests designed to demonstrate protection of the product.

PRODUCT PROS COMPETITION GUIDE (p. 2)

COMPETITION: Present your product, packaging design, and marketing campaign to a panel of company executives. The presentations will be judged on the following criteria:

3. Product selected clearly meets the criteria, and the evidence is clearly articulated in the presentation
4. Packaging design clearly meets the criteria, and the evidence is clearly articulated in the presentation
5. Marketing campaign clearly meets the criteria, and the evidence is clearly articulated in the presentation
6. Product testing clearly matches the criteria, and the evidence is clearly articulated in the presentation
7. Presenters appear to be well- prepared, speaking clearly and coherently and making eye contact
8. Presentation is energetic, creative, and engaging.
- 9.

Appendix B: Module Rubrics
Rubric 1: Design Challenge Rubric

Criteria One										
Product selected clearly meets the criteria, and the evidence is clearly articulated in the presentation.										
Yes Mostly			Somewhat					Not at all		
10	9	8	7	6	5	4	3	2	1	0
Criteria Two										
Packaging design clearly meets the criteria, and the evidence is clearly articulated in the presentation.										
Yes Mostly			Somewhat					Not at all		
10	9	8	7	6	5	4	3	2	1	0
Criteria Three										
Marketing campaign clearly meets the criteria, and the evidence is clearly articulated in the presentation.										
Yes			Mostly		Somewhat				Not at all	
10	9	8	7	6	5	4	3	2	1	0
Criteria Four										
Product testing clearly matches the criteria, and the evidence is clearly articulated in the presentation										
Yes			Mostly		Somewhat				Not at all	
10	9	8	7	6	5	4	3	2	1	0
Criteria Five										
Presenters appear to be well- prepared, speaking clearly and coherently and making eye contact										
Yes			Mostly		Somewhat				Not at all	
10	9	8	7	6	5	4	3	2	1	0
Criteria Six										
Presentation is energetic, creative, and engaging.										
Yes			Mostly		Somewhat				Not at all	
10	9	8	7	6	5	4	3	2	1	0

Rubric 2: Save the Chip Challenge Design Rubric

	1 Below Mastery	2 Approaching Mastery	3 At Mastery	4 Advanced
Problem Clarification	Students misunderstood the problem and/or didn't clarify the problem in the presentation.	Students' understanding of the problem is shallow and/or not clarified well in the presentation.	Students understanding of the problem is evident in that problem is discussed and reworded. However, students may not use technical language when describing the problem.	Students understanding of the problem is evident in that the problem is discussed and reworded systematically. Students use technical language accurately when describing the problem. Students were able to analyze how the parts of the whole interacted to produce the overall complex solution.
Concept Design	The design does not show use of the engineering design process. The design is not effective and does not use the parameters included in the challenge.	The design shows little use of the engineering design process. The design is not effective but attempts to use the parameters included in the challenge.	The design uses the engineering design process. The design is effective and uses the parameters included in the challenge.	The design is sophisticated and shows that students have refined their initial designs to make it more appealing and effective. The student used the design competition parameters to create an effective product.

	1 Below Mastery	2 Approaching Mastery	3 At Mastery	4 Advanced
Communication	Students were not able to effectively communicate their design process and success and failure to the panel.	Students explained their ideas but may not have been effective at sharing those ideas. Students did not attempt to listen and respond to the panel's questions.	Students were able to explain their thoughts and ideas to the panel using oral, written, or non-verbal communication skills but not all three. Students were able to listen to and respond effectively to questions posed during the presentation.	Students were able to clearly articulate their thoughts and ideas effectively through oral, written, and nonverbal communication skills. Students were able to listen to and respond effectively to questions posed during presentation.
Group Collaboration and Cooperation	Students did not demonstrate the ability to work effectively and respectfully with their team. They did not work together well and failed to make compromises for the good of the project. They did not respect the contributions of the team.	Students struggled to work effectively and respectfully with their team. However, they make an attempt to make compromises and listen to their teammates.	Students were able to work effectively as a team. They made compromises at times but may have had difficulty respecting the contributions of their teammates.	Students demonstrated the ability to work effectively and respectfully with their team. They exercised flexibility and willingness to help in making necessary compromises to accomplish a common goal. They assumed shared responsibility for collaborative work and valued contributions made by each team member.

Appendix C

Three-Act Lesson Video and Images (Math)

Link to Three Act Video – Act 1

<https://www.youtube.com/watch?v=TbO79YIBu00>

Act Two:

Outside Large Package



Outside Small Package



Large and Small Packages Poured Out



Inside Large Package



Inside Small Package



Nutritional Information: Doritos Packages

Questions? Call 1-800-352-4477
 1-800-352-4477
 Mon-Fri 9:00am to 4:30pm CT
 email or chat at fritolita.com
 Please retain product and package.

Nutrition Facts

Serving Size 1 oz (28g/About 11 chips)
 Servings Per Container About 11

Amount Per Serving	Calories from Fat 70
Calories 140	% Daily Value*
Total Fat 8g	12%
Saturated Fat 1g	6%
Trans Fat 0g	
Cholesterol 0mg	0%
Sodium 210mg	9%
Total Carbohydrate 16g	5%
Dietary Fiber 1g	4%
Sugars 0g	
Protein 2g	

Vitamin A 0%	Vitamin C 0%
Calcium 0%	Iron 0%
Thiamin 2%	Vitamin B6 2%

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories: 2,000	2,500
Total Fat	Less than 65g	80g
Sat Fat	Less than 20g	25g
Cholesterol	Less than 300mg	300mg
Sodium	Less than 2,400mg	2,400mg
Total Carbohydrate	300g	375g
Dietary Fiber	25g	30g

Calories per gram:
 Fat 9 • Carbohydrate 4 • Protein 4

Ingredients: Corn, Vegetable Oil (Sunflower, Canola, and/or Corn Oil), Maltodextrin (Made From Corn), Salt, Cheddar Cheese (Milk, Cheese Cultures, Salt, Enzymes), Whey, Monosodium Glutamate, Buttermilk, Romano Cheese (Part-Skim Cow's Milk, Cheese Cultures, Salt, Enzymes), Whey Protein Concentrate, Onion Powder, Corn Flour, Natural and Artificial Flavor, Dextrose, Tomato Powder, Lactose, Spices, Artificial Color (Including Yellow 6, Yellow 5, and Red 40), Locust Acids, Citric Acid, Sugar, Garlic Powder, Skim Milk, Red and Green Bell Pepper Powder, Disodium Inosinate, and Disodium Guanylate.
CONTAINS MILK INGREDIENTS.

Appendix D
Too Many Broken Chips!

How many chips are in your bag?

What fraction of the chips were broken? Write this as a percent. Be sure to explain how you found your answer using pictures, words, and symbols.

As a group, calculate the average number of broken chips.

What is the class average number of broken chips? How could you figure this out? Do you think this an acceptable amount? What do you think other students at your school will say is acceptable? How could we find an answer to that question?

Appendix E – Problem Solution Graphic Organizer

Problem

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Potential Solutions to the Problem

What solutions did you attempt?	What were the results of those attempts?

Best Possible Solution and Why

What is the best solution and why?